



**Fall 2014
SEI Research Review**

**Team Attributes & Team
Performance—
*FY14-7 Expert Performance and
Measurement***

Software Engineering Institute
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Pittsburgh, PA 15213

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10-26-14



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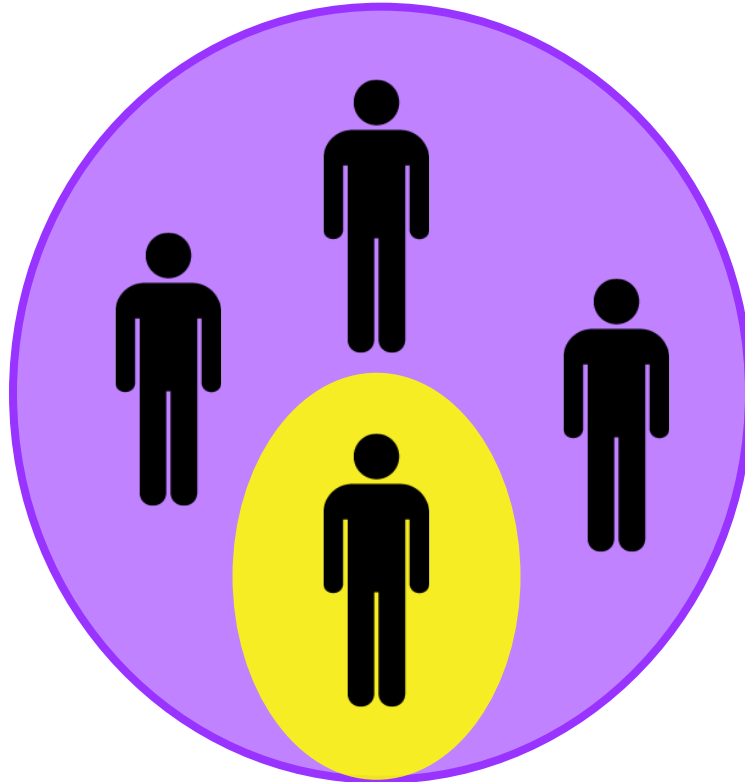


What is an expert?

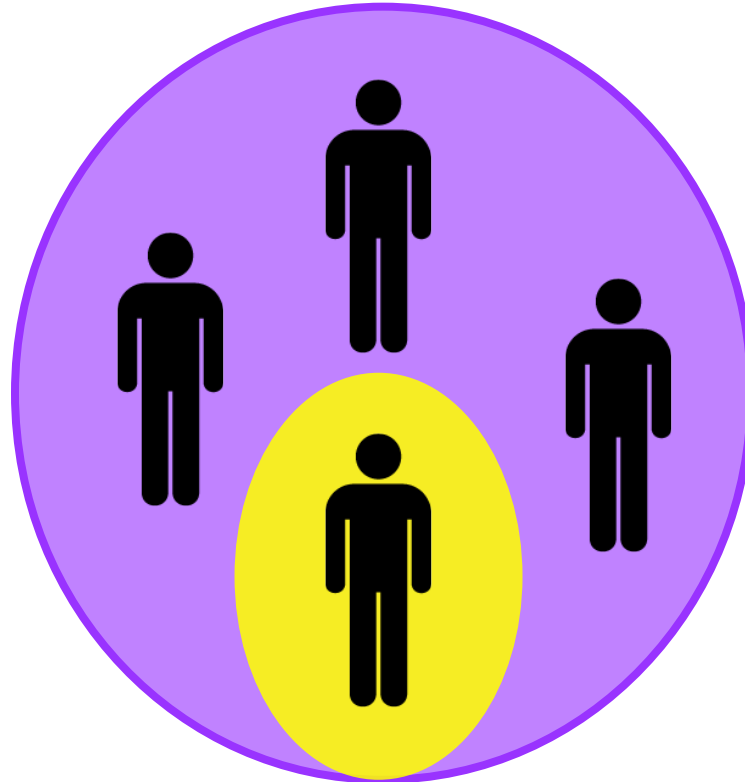
How do we get more of them?



What is an expert in this context?



What is an expert in this context?



Traditional Performance Attributes- Speed and Accuracy

Violinist

- Accuracy is important
- Speed is not



Long distance running

- Speed is important
- Accuracy is not



Attributes of our definition of experts in cybersecurity

- Job function level with generalizable tasks
- Reliability
- Speed of only accurate performance

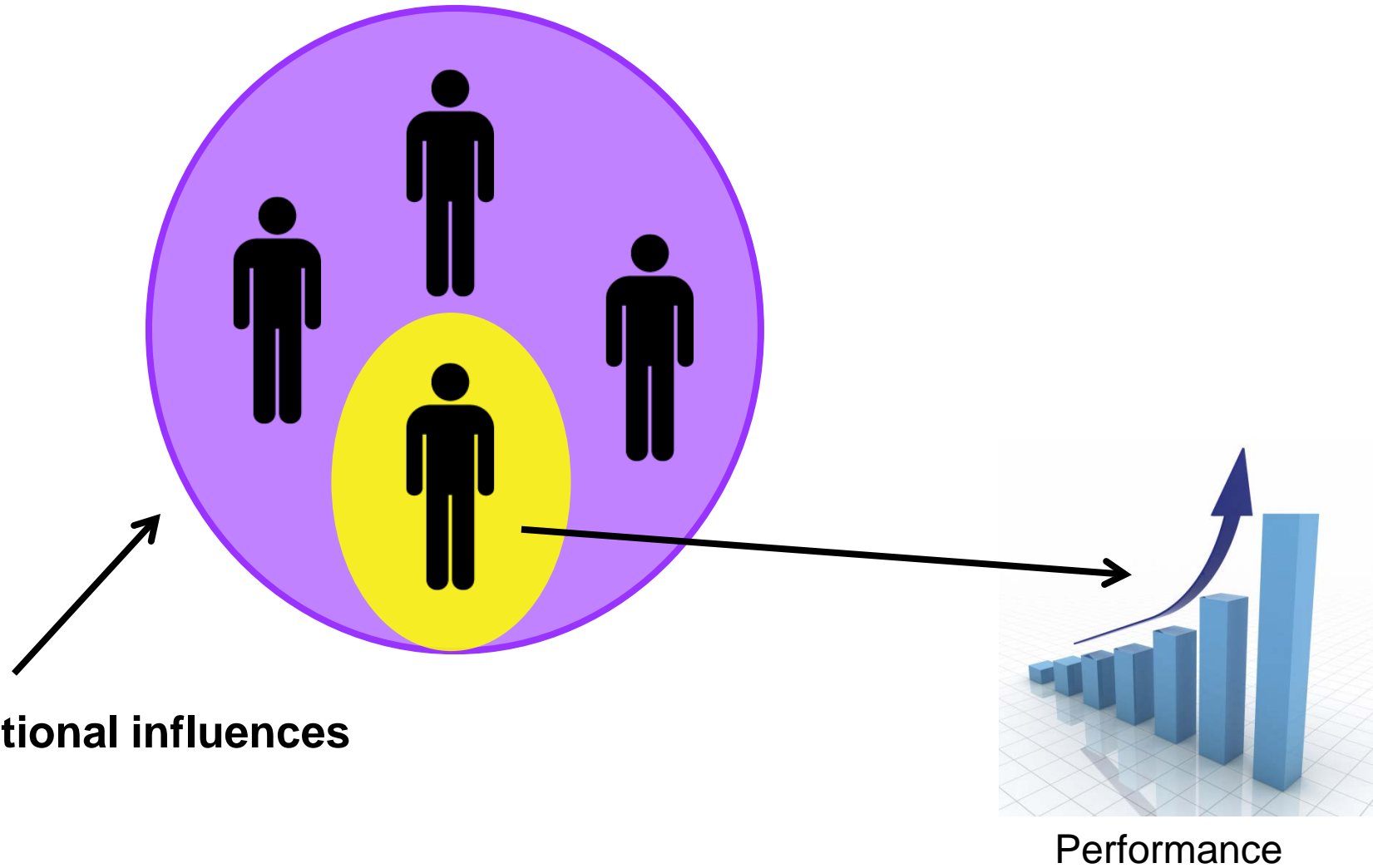


Why do we care?

- Expert systems
- Socially-elected experts
- Personnel selection
- Training



Other impacts to the development of expertise

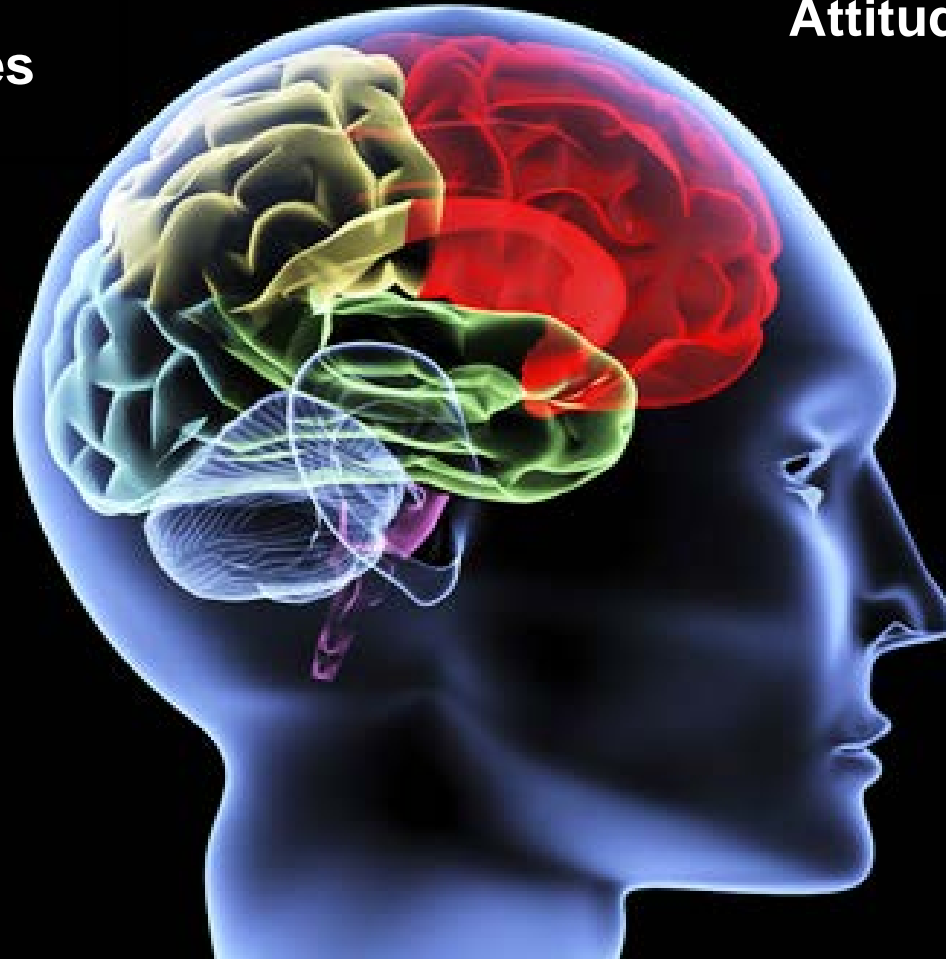


Past research focused on these individual factors:

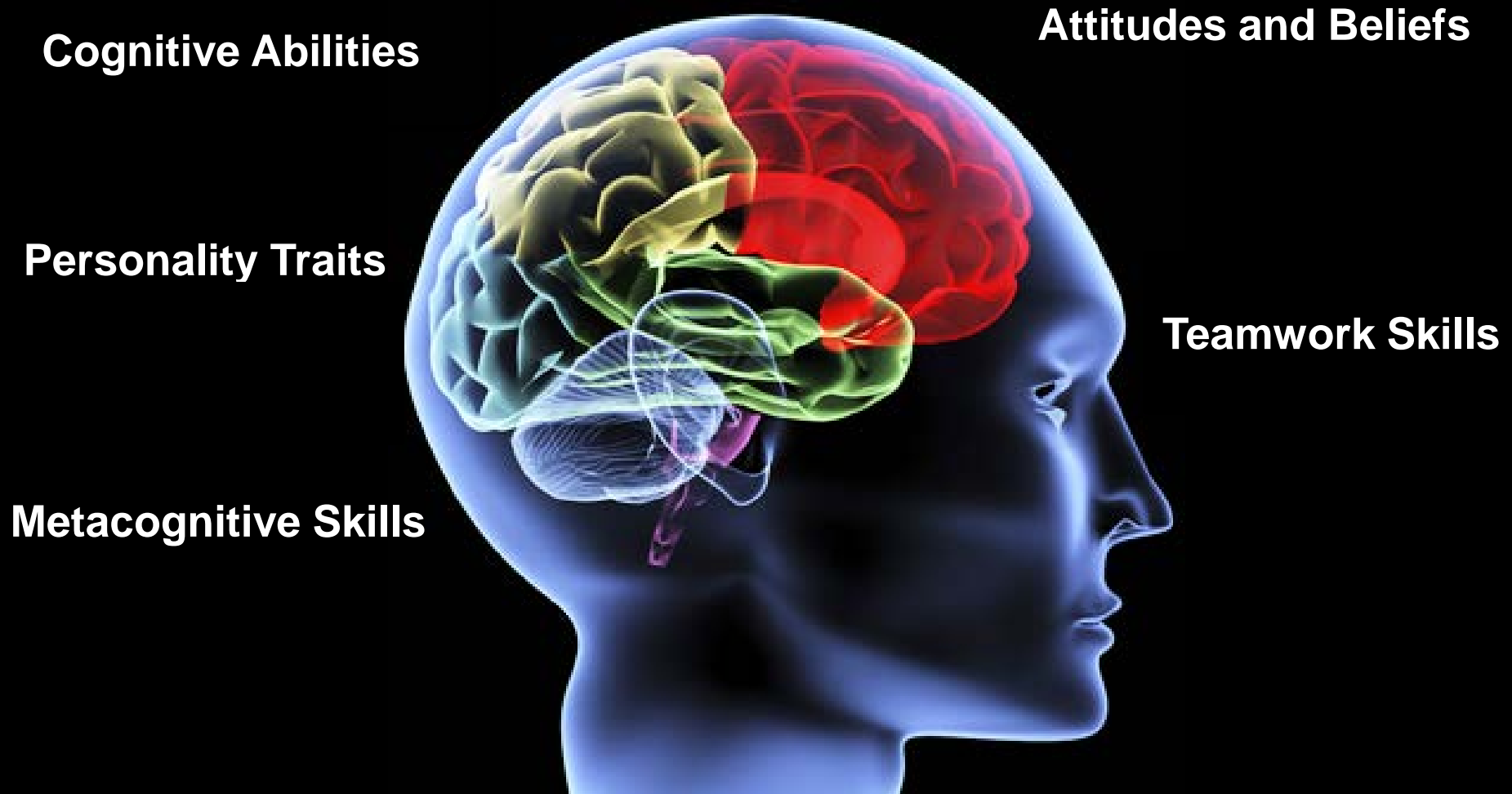
Cognitive Abilities

Attitudes and Beliefs

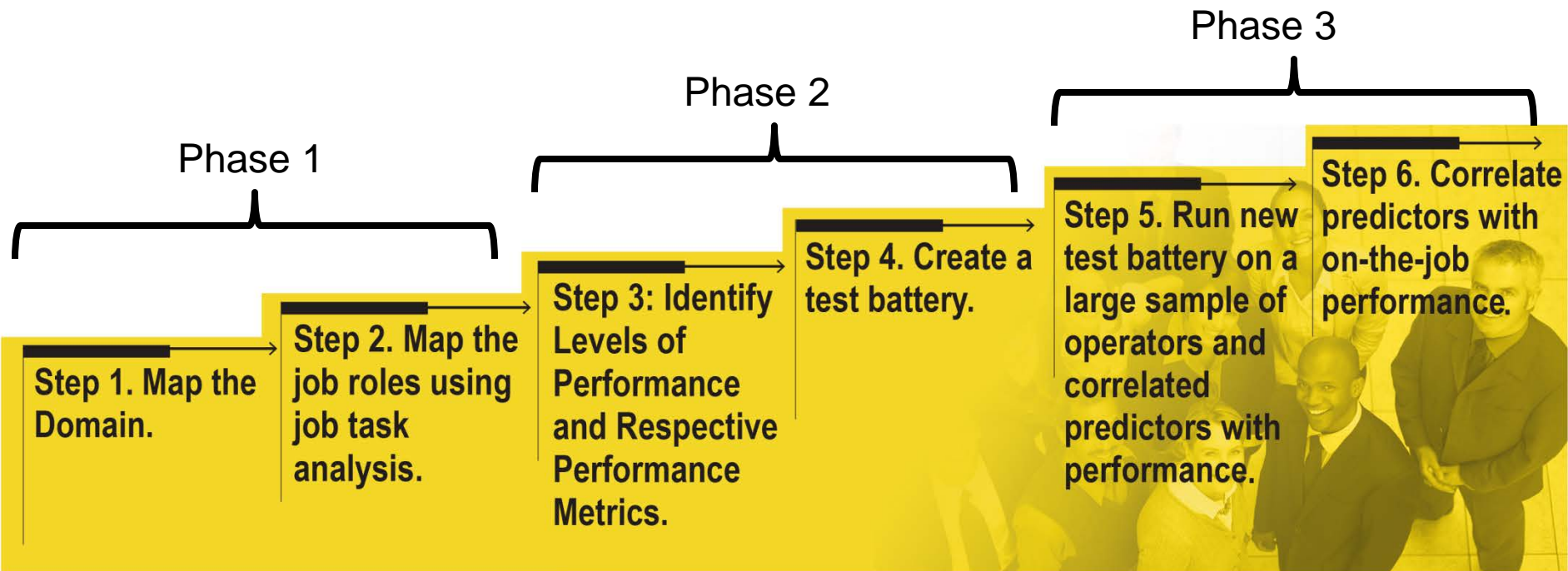
Personality Traits



Our contribution:



Multi-Year Research Process



Past FY13 Work



FY13 Research

Phase 1

Step 1. Map the Domain.

Step 2. Map the job roles using job task analysis.

Step 3: Identify Levels of Performance and Respective Performance Metrics.

Step 4. Create a test battery.

Step 5. Run new test battery on a large sample of operators and correlated predictors with performance.

Step 6. Correlate predictors with on-the-job performance.



Target Population

Malicious-code reverse engineers



**reverse
engineer**

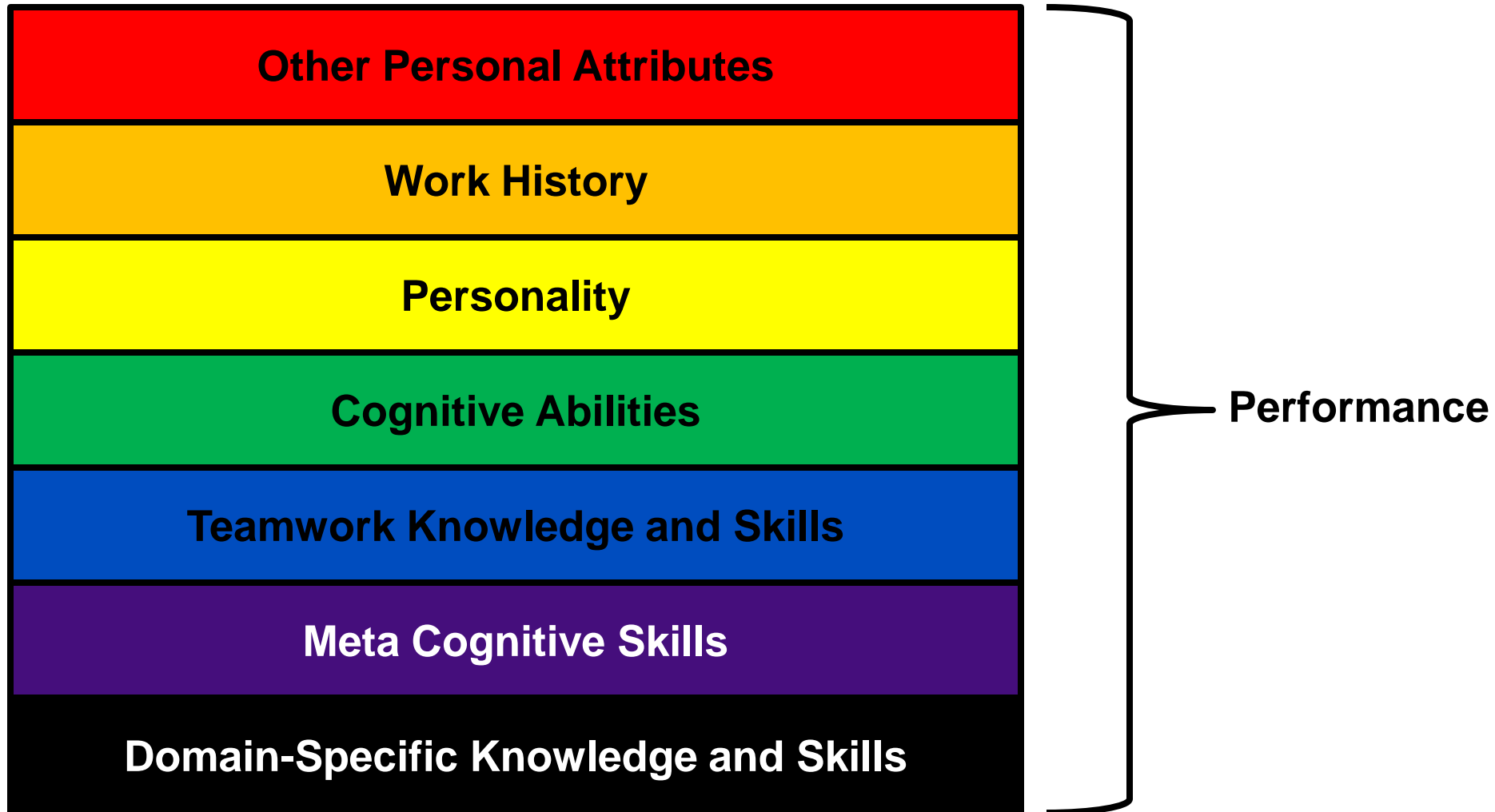


Research Question

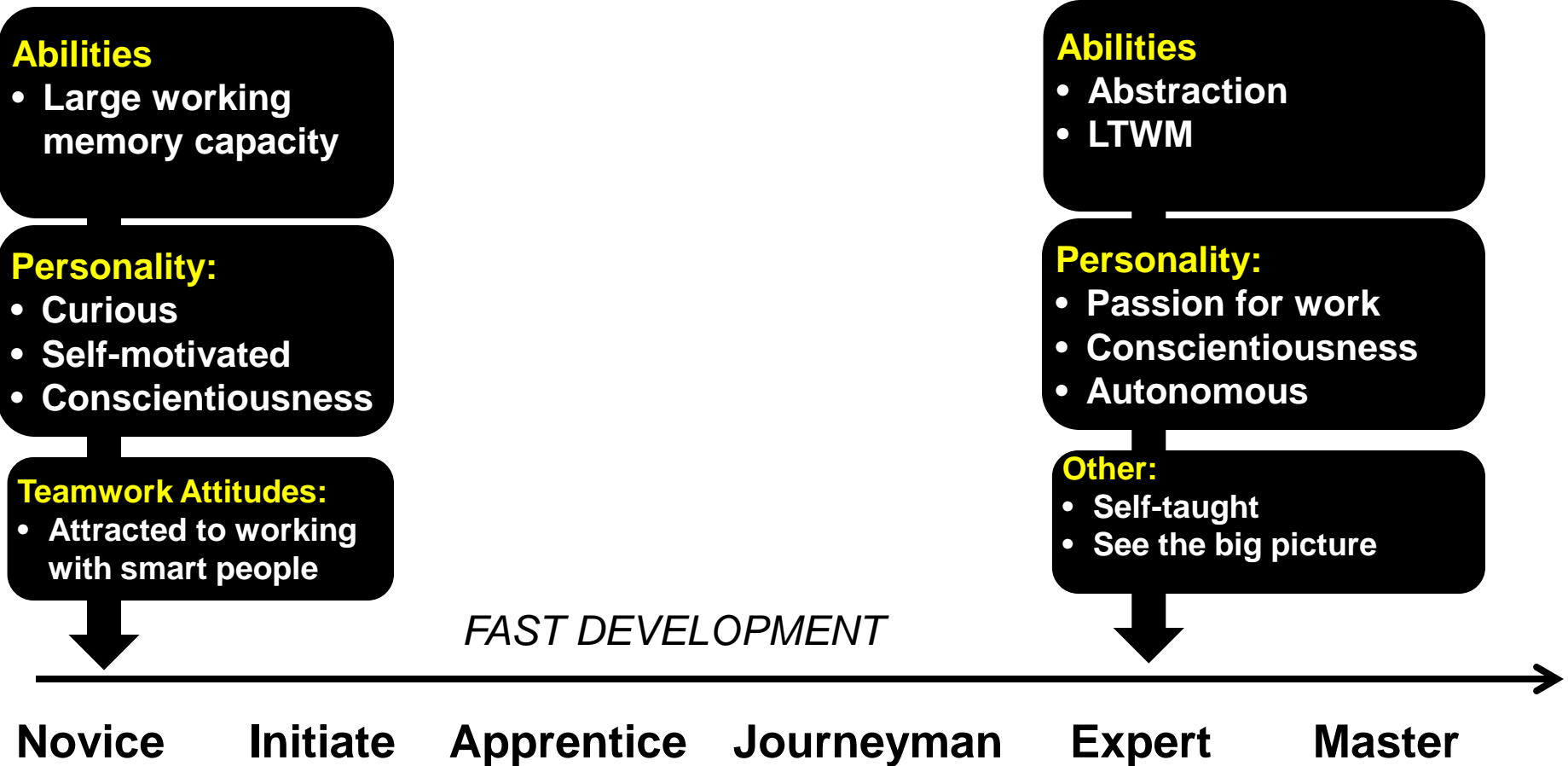
Predictors
of the
development of experts
in malicious-code reverse engineering?



Types of Factors Responsible for Performance



Results of Step 2



Organizational Factors

- **Time spent in deliberate practice = # 1 predictor of expertise**
- Create environment that maximizes deliberate task engagement
 - Attract interesting work
 - Minimize distractions
 - Evaluate policies and procedures that reduce task engagement time
 - Groom and retain experts



Current Work



FY14-15 Work

Phase 2

Step 1. Map the Domain.

Step 2. Map the job roles using job task analysis.

Step 3: Identify Levels of Performance and Respective Performance Metrics.

Step 4. Create a test battery.

Step 5. Run new test battery on a large sample of operators and correlated predictors with performance.

Step 6. Correlate predictors with on-the-job performance.



Step-by-step method

1. **Generate all metrics for objective task performance**
2. **Use existing job analysis results to generate test battery**
3. **Beta-test metrics on student individuals and teams**
4. **Regress test battery factors on objective performance metrics**
5. **Evaluate metrics**



Target Population



Cyber Defender Teams



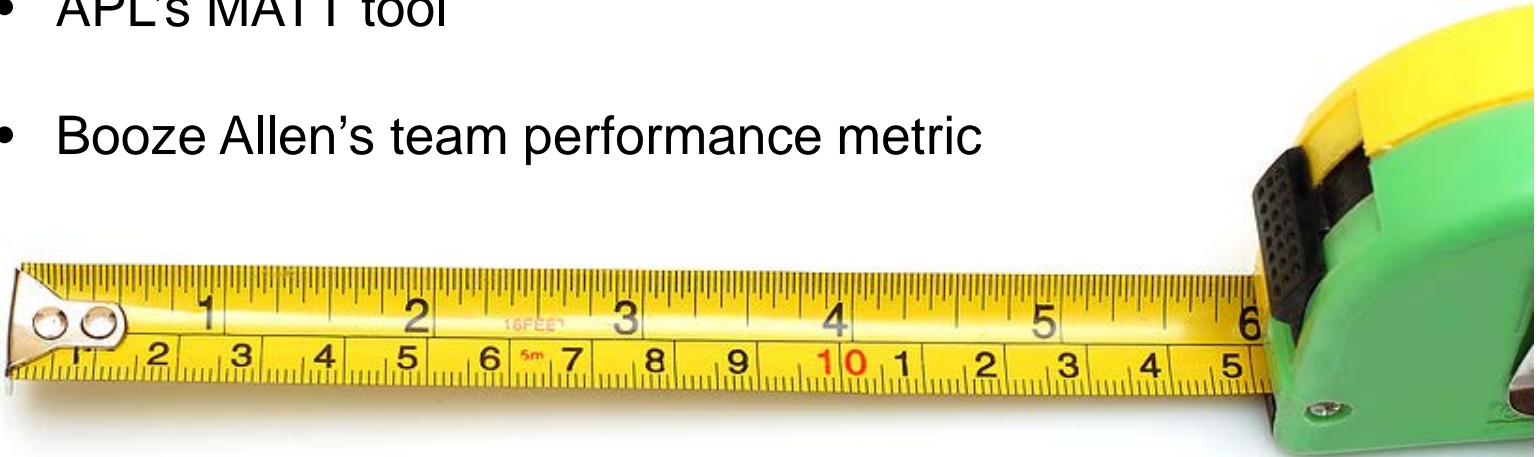
Teams and Events

Team	Event
Sandia National Labs	TRACERFIRE 2014
US Army Reserves	Cyber Endeavor, 2014 & MIT-LL Project C
US Army National Guard	Cyber Shield 2015
West Point	Weekend CTFs



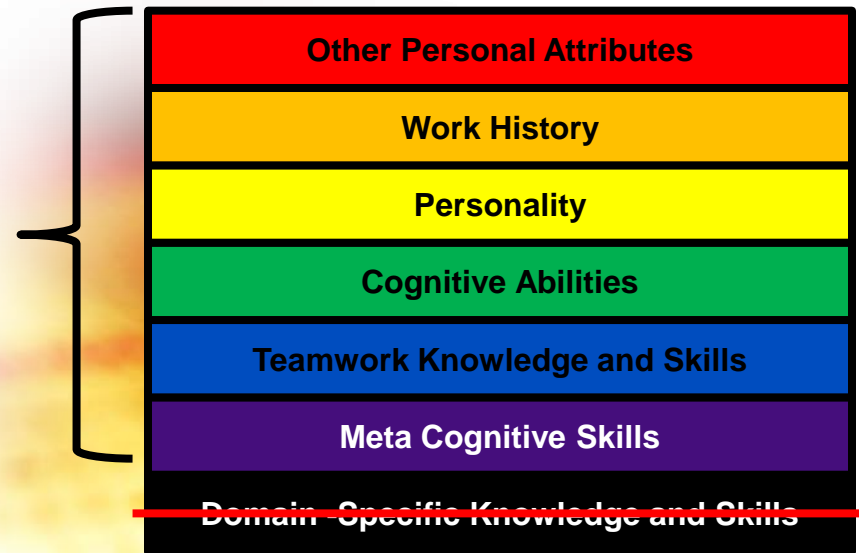
Step 3 Task Performance Metrics Generated

- **Individual Performance Metrics**
 - Rotem Guttman's work
- **Team Performance Metrics**
 - APL's MATT tool
 - Booze Allen's team performance metric



Step 4 Test Battery

- Neo PI-3 sub scales
- AIS Inventory
- Team Interaction Inventory
- Bio-data



Some
dimensions
tested in
Team
Interaction
Inventory

Team Competencies (*Cannon-Bowers et al., 1995*)

Knowledge	Skills	Attitudes
<ul style="list-style-type: none"> • Shared task models • Knowledge of team mission, objectives, norms • Task sequencing • Accurate problem models • Understanding teamwork skills • Knowledge of boundary spanning roles • Teammate characteristics 	<ul style="list-style-type: none"> • Adaptability, flexibility, dynamic reallocation of function, compensatory behavior • Shared situation awareness • Mutual performance monitoring and feedback self-correction • Leadership/team management, conflict resolution assertiveness • Coordination and task integration • Communication • Decision making 	<ul style="list-style-type: none"> • Team orientation • Conflict efficacy • Shared vision • Team cohesion • Mutual trust • Collective orientation

What avenues does this research open up?

Professionalization- the social process by which any trade or occupation transforms itself into a true "**profession of the highest integrity and competence**"



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Fuzzy Line Between *Identifiers* and *Predictors*

“FACTORS”

